What is claimed is:

1. A communication apparatus employing a multi-carrier transmission method which performs data transmission with digital multi-carrier modulation and demodulation processes utilizing a real coefficient wavelet filter bank, which comprises a receiver that performs a digital multi-carrier demodulation process, wherein

the receiver having a wave detecting section,

the wave detecting section has:

a first wavelet transformer involving M real coefficient wavelet filters, which are orthogonal with respect to each other, for performing a wavelet transform of waveform data of received signal;

a Hilbert transformer for performing a Hilbert transform of the waveform data;

a second wavelet transformer for performing a wavelet transform of outputs from the Hilbert transformer; and

a complex data generator for generating complex data, by defining outputs from the first wavelet transformer as in-phase components of complex information and outputs from the second wavelet transformer as orthogonal components of the complex information.

2. The communication apparatus according to claim 1,

further comprising:

a code converter for inverting codes of outputs in odd-numbered places among M outputs from the second wavelet transformer.

3. The communication apparatus according to claim 2, further comprising:

a level converter for correcting fluctuation of amplitude of outputs from the code converter, which is caused by a ripple of the Hilbert transformer.

4. A communication apparatus employing a multi-carrier transmission method which performs data transmission with digital multi-carrier modulation and demodulation processes utilizing a real coefficient wavelet filter bank, which comprises a receiver that performs a digital multi-carrier demodulation process, wherein

the receiver having a wave detecting section,

the wave detecting section has:

a first wavelet transformer involving M real coefficient wavelet filters, which are orthogonal with respect to each other, for performing a wavelet transform of waveform data of received signal;

a second wavelet transformer involving wavelet filters for performing a Hilbert transform, a wavelet

transform, and an inversion of codes in odd-numbered places, for the waveform data; and

a complex data generator for generating complex data, by defining outputs from the first wavelet transformer as in-phase components of the complex information and outputs from the second wavelet transformer as orthogonal components of the complex information.

5. The communication apparatus according to claim 1, wherein

the first wavelet transformer has a first prototype filter including a first polyphase filter which possesses a real coefficient, M down samplers, M-1 one-sample delaying elements, and a fast M-points discrete cosine transformer (M is an integer not less than 2), and

the second wavelet transformer has a second prototype filter including a second polyphase filter which possesses a real coefficient, M down samplers, M-1 one-sample delaying elements, and a fast M-points discrete sine transformer.

6. The communication apparatus according to claim 1, wherein

the second wavelet transformer has a third prototype filter including a second polyphase filter which possesses

a real coefficient, M down samplers, M-1 one-sample delaying elements, a time series inverter for inverting sequence of every M inputs among an input series, a fast M-points discrete cosine transformer, and a code converter for inverting codes in odd-numbered places in the input series.

7. The communication apparatus according to claim 1, wherein

the receiver further has:

an equalizer for performing equalization using complex information obtained from the wave detecting section and known signal for equalization that is previously assigned for the equalization process; and

a judgment unit for making a judgment using signal obtained from the equalizer.

8. A communication apparatus employing a multi-carrier transmission method which performs data transmission with digital multi-carrier modulation and demodulation processes utilizing a real coefficient wavelet filter bank, which comprises a transmitter that performs a digital multi-carrier modulation process and a receiver that performs a digital multi-carrier demodulation process, wherein

the transmitter has:

a synchronization data generator for generating data for synchronization that remain same for a duration of several consecutive symbols and that are known in the receiver; and

an inverse wavelet transformer for performing an inverse wavelet transform of the synchronization data, and

the receiver has:

a wave detecting section having a first wavelet transformer involving M real coefficient wavelet filters, which are orthogonal with respect to each other, for performing a wavelet transform of waveform data of received signal; a Hilbert transformer for performing a Hilbert transform of the waveform data; a second wavelet transformer for performing a wavelet transform of outputs from the Hilbert transformer; and a complex data generator for generating complex data, by defining outputs from the first wavelet transformer as in-phase components of complex information and outputs from the second wavelet transformer as orthogonal components of the complex information;

an equalizer for performing equalization using complex information obtained from the wave detecting section and known signal for equalization that is previously assigned for the equalization process;

a judgment unit for making a judgment using signal obtained from the equalizer; and

a synchronization timing estimating circuit for estimating a timing of synchronization of symbols from phase differences between adjacent complex subcarriers output from the wave detecting section.

9. A communication apparatus employing a multi-carrier transmission method which performs data transmission with digital multi-carrier modulation and demodulation processes utilizing a real coefficient wavelet filter bank, which comprises a transmitter that performs a digital multi-carrier modulation process and a receiver that performs a digital multi-carrier demodulation process, wherein

the transmitter has:

a synchronization data generator for generating data for synchronization that remain same for a duration of several consecutive symbols and that are known in the receiver; and

an inverse wavelet transformer for performing an inverse wavelet transform of the synchronization data, and

a wave detecting section of the receiver has:

a wavelet transformer involving M real coefficient wavelet filters, which are orthogonal with respect to each other, for performing a wavelet transform of waveform data of received signal;

a complex data generator for generating complex data,

by defining (2n-1)th outputs(n is a positive integer) from the wavelet transformer as in-phase components of the complex information and 2n-th outputs (where $1 \leqq n \leqq (M/2-1)$ and subcarriers are numbered from 0 to M-1) from the wavelet transformer as orthogonal components of the same.

10. A communication apparatus employing a multi-carrier transmission method which performs data transmission with digital multi-carrier modulation and demodulation processes utilizing a real coefficient wavelet filter bank, which comprises a transmitter that performs a digital multi-carrier modulation process and a receiver that performs a digital multi-carrier demodulation process, wherein

a modulating section of the transmitter has:

a symbol mapper for converting bit data into symbol data and mapping the symbol data to M/2 (M is a plural number) complex coordinate planes;

an inverse wavelet transformer involving M real coefficient wavelet filters, which are orthogonal with respect to each other; and

a complex data decomposer for decomposing complex data into a real part and an imaginary part such that in-phase components of the complex information are supplied to the inverse wavelet transformer as (2n-1)th (n is a

positive integer) inputs and such that orthogonal components of the complex information are supplied to the inverse wavelet transformer as 2n-th (where $1 \leqq n \leqq (M/2-1)$ and subcarriers are numbered from 0 to M-1) inputs.

11. A communication apparatus employing a multi-carrier transmission method which performs data transmission with digital multi-carrier modulation and demodulation processes utilizing a real coefficient wavelet filter bank, which comprises a transmitter that performs a digital multi-carrier modulation process and a receiver that performs a digital multi-carrier demodulation process, wherein

the transmitter has:

a synchronization data generator for generating data for synchronization that remain same for a duration of several consecutive symbols and that are known in the receiver; and

a modulating section for modulating with the synchronization data,

the receiver has:

a wave detecting section having a wavelet transformer involving M real coefficient wavelet filters, which are orthogonal with respect to each other, for performing a wavelet transform of waveform data of received signal; a complex data generator for generating complex data, by

defining (2n-1)th outputs(n is a positive integer) from the wavelet transformer as in-phase components of the complex information and 2n-th outputs (where $1 \leqq n \leqq (M/2-1)$ and subcarriers are numbered from 0 to M-1) from the wavelet transformer as orthogonal components of the same; and

a synchronization timing estimation circuit for estimating a timing of synchronization of symbols from phase differences between adjacent complex subcarriers.

12. The communication apparatus according to claim 8, wherein

the receiver has:

an equalizer for obtaining an equivalent coefficient to be used for each subcarrier by synthesizing (2n-1)-th outputs and 2n-th outputs ($1 \leqq n \leqq (M/2-1)$, the subcarriers being numbered from 0 to M-1) with complex information obtained from the wave detecting section; and

a judgment unit for making a judgment using signal obtained from the equalizer.

13. A communication apparatus utilizing a power line as a transmission path, comprising a transmitter that performs a digital multi-carrier modulation process and a receiver that performs a digital multi-carrier demodulation process, and utilizing a filter bank involving a plurality of

filters in a modulation/demodulation process section,

a transmitting section of the transmitter has:

a symbol mapper for converting bit data into symbol data and mapping the symbol data according to certain signal point mapping information; and

a modulator, which utilizies a filter bank involving M filters orthogonal to each other, for performing an inverse transform of a signal to be transmitted which is signal-points-arranged by the symbol mapper to modulate, and

a wave detecting section of the receiver has a filter bank, which involves M filters that are orthogonal with respect to each other, for transforming a received signal to demodulate.

14. The communication apparatus according to claim 13, wherein filter length of the filters of the transmitter and the receiver is 4M.